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(54) Method and apparatus for securing mains powered electrical equipment

(57) The mains-supply lead (3) for supplying electrical power to the equipment (2) forms part of a monitoring circuit for determining the status of the equipment (2) and whether an alarm should be activated. The invention provides for monitoring apparatus (1) which can provide a monitoring signal by way of the mains-supply lead (3) so as to determine if an unauthorised power-up of the equipment has occurred, or whether an attempt has been made to disconnect the equipment from its mains supply, irrespective of whether the equipment (2) is being supplied with mains current at that time.

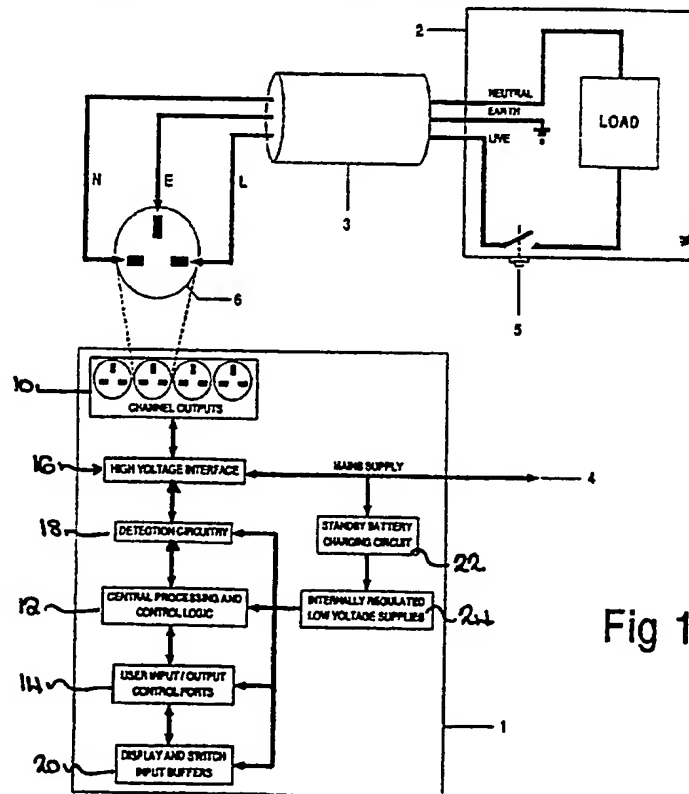


Fig 1

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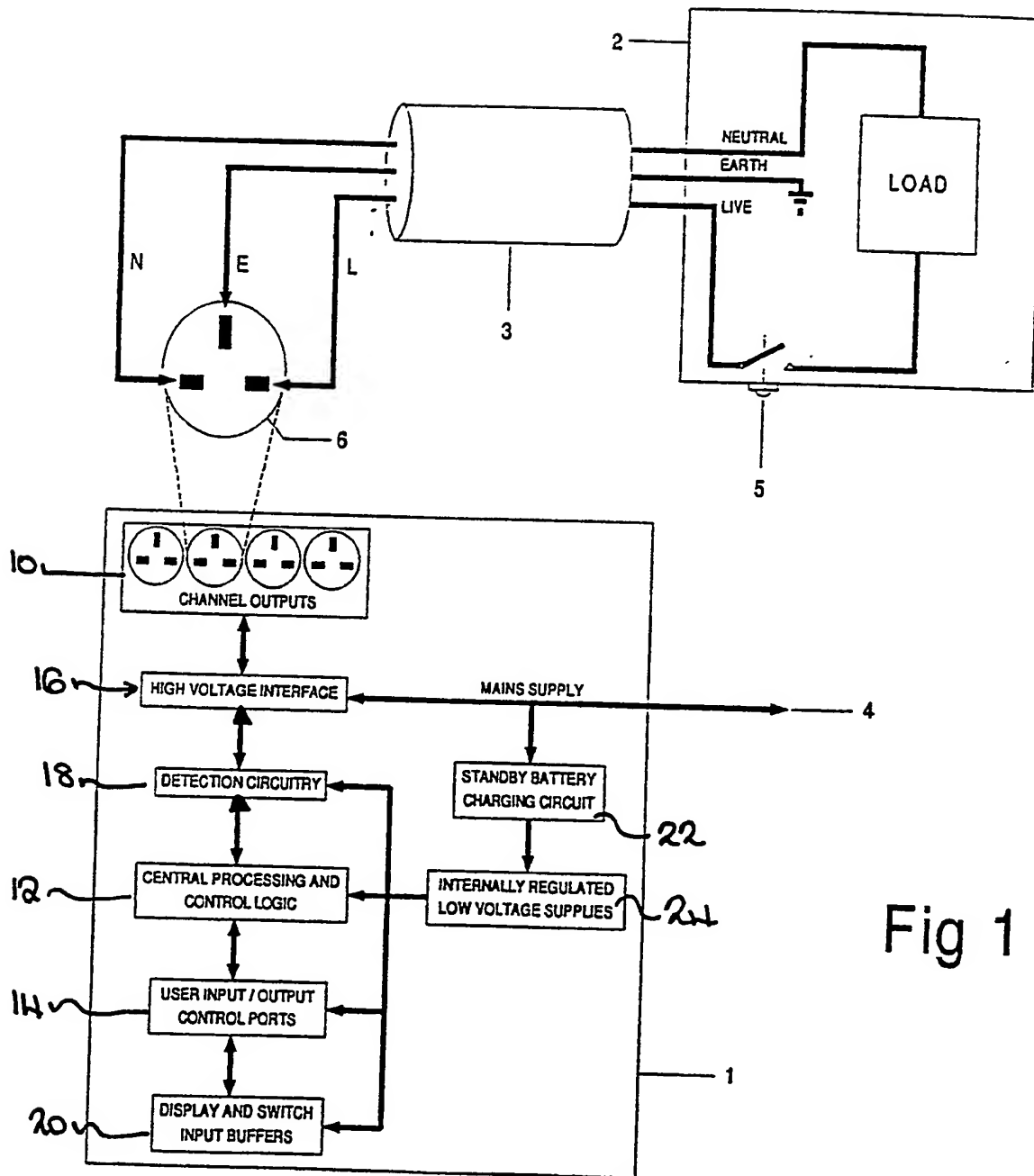


Fig 1

METHOD AND APPARATUS FOR SECURING MAINS POWERED
ELECTRICAL EQUIPMENT

5 The present invention relates to a method and
apparatus for securing mains powered electrical equipment.

 Currently, there are two main methods for securing
valuable mains powered electrical equipment, for example,
10 computer terminals, against theft. The first method is to
physically constrain the computer terminal, or other
equipment, for example, by bolting it or otherwise securing
it to a work station. The alternative approach is to
incorporate on or in the computer terminal or other
15 equipment a movement sensor, such as an inertia switch or
piezo ceramic shock element, so that an alarm is given if
the computer terminal is moved. However, these physical
methods are not ideal and can cause difficulties, for
example when it is wanted to resite equipment. Such
20 physical security may be resisted, for example, to ensure
that flexibility to position equipment in a work place is
retained.

 With equipment such as computer terminals there is
25 also a wish to protect sensitive information stored
therewithin from access. Of course, the physical
protection of the computer terminal as described above does
not assist in protecting the information stored in the
computer terminal. At present, such information is
30 protected by such devices as password protected software,
physical locking devices on disc drives, and electronic
internal hardware protection cards.

 It is an object of the present invention to provide a
35 method and apparatus of securing mains powered electrical
equipment which does not have the disadvantages associated

with a physical restraint system.

According to a first aspect of the present invention there is provided a method of securing mains powered electrical equipment using the mains power lead thereof as
5 the, or a part of, a monitoring circuit for the equipment.

According to a further aspect of the present invention there is provided a method of securing mains powered electrical equipment, said method comprising the steps of
10 coupling a mains electrical supply to equipment to be secured by way of a monitoring circuit, the monitoring circuit being arranged to apply electrical signals to said equipment, monitoring the application of the electrical
15 signals to the equipment, and signalling an alarm if the application of electrical signals to the equipment is disrupted.

Preferably said method includes the step of monitoring
20 said equipment to determine if operating power has been supplied to said equipment. Also, said equipment may be monitored to determine if the supply of operating power has been disrupted.

The invention can therefore advantageously be employed
25 to determine if an unauthorised power-up of the equipment has occurred, and also if an attempt to remove the equipment from its power supply is made. This greatly enhances the security provided by the invention.

30 A method of an embodiment of the invention monitors the application of electrical signals to the equipment, and if the equipment is moved necessitating its disconnection from the mains supply, an alarm is signalled. The method
35 of the embodiment of the invention has the considerable advantage that no modifications need to be made to the

equipment to be secured.

5 Preferably, the method comprises the further step of keeping the power switch of the equipment to be secured in its on position. For example, the power switch may be kept in its on position by the application of a tamper proof label thereto.

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10 Preferably, the electrical signals applied to the equipment by the monitoring circuit comprise selectively a monitoring signal for application to the equipment when not in use, and an electrical power supply for powering the equipment in use.

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15 The monitoring signal is preferably a DC signal, for example, a series of low voltage pulses, which is applied to the equipment when it is not in use by way of its normal power supply lead. However, the monitoring signal may comprise a synthesized low voltage 50Hz AC signal. Of course, the power supply lead is electrically connected to the equipment to be secured by way of its power switch which is kept in its on position. It will be appreciated that the monitoring signal will be applied to the equipment to be secured by way of the live wire of the power supply lead and returned to the monitoring circuit by way of the neutral wire. In particular, the invention is advantageous in only requiring use of the live and neutral wires. The monitoring circuit is arranged to detect the returned monitoring signal and to signal an alarm if the monitoring signal is disrupted. Disruption of the monitoring signal may occur, for example, where the equipment to be secured is disconnected from the monitoring circuit, and/or where mains power is applied to the equipment. The disconnection of the equipment may indicate, for example, that the equipment is being physically removed, whereas the application of power to the equipment may indicate that

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unauthorised access is required to the equipment, such as a computer, for example, to access sensitive information therein.

5 The aforementioned feature leads to a particular
advantage of the present invention. Power to the equipment
can be arranged to be under the direct control of the
security system. As such, the application of power to the
equipment may only be achieved by entering a predetermined
Personnel Identification Number (PIN) into a keyboard
associated with the security system of the invention.
During the time that the equipment is not powered-up, the
security status of the equipment is monitored by a
monitoring signal which is injected from the monitoring
15 circuit into the equipment. If this signal is interrupted
for any reason, a full alarm condition will occur.
Interruption of this signal can occur either by virtue of
the equipment being disconnected from the main supply, or
by virtue of the equipment becoming powered-up so that a
20 mains current is conducted along the mains lead from the
mains supply.

25 To power-up the equipment in an authorised manner, it
is necessary to enter the correct PIN to the security
system keyboard. The monitoring signal may then be
automatically interrupted and the further security of the
equipment is subsequently achieved by monitoring the mains
supply current. If the mains supply current is
interrupted, for example due to the mains lead being
30 disconnected, a full alarm condition will then occur.

35 In this manner, use or removal of the equipment can
only be achieved without leading to a full alarm condition
by entering the correct PIN. The invention can also be
arranged such that removal of the security label, which is
available for keeping the power switch of the equipment in

its ON position, will also lead to a full alarm condition.

When it is required to use the equipment legitimately,
5 the method comprises removing the application of the
monitoring signal and applying the mains power supply
thereto to power the equipment.

Preferably, selection of the electrical signal is
10 enabled only in authorised circumstances. For example,
control of the monitoring circuit may be, for example, by
way of a key or by a coded input.

When the equipment is legitimately powered, the
15 monitoring circuit monitors the electrical power supplied
and signals an alarm in the event of any disruption to the
power supply. As previously, disruption to the power
supply may indicate that the equipment has been
disconnected and thus that the equipment is being
20 physically removed.

In an embodiment, an alarm is also signalled if the
mains power supplied to the monitoring circuit is
disrupted. This may indicate that the monitoring circuit
25 has been disconnected from the mains power supply, for
example, to physically remove the equipment, and/or that
there is an interruption or failure of the power supply.

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The alarm to be signalled by the monitoring circuit
30 may be made in any required manner. For example, the
method may provide that visual displays are actuated and/or
that audible alarms are sounded. The visual displays,
sounders and other indicator means may be located remote
from the monitoring circuit, if required. Actuation of the
35 indicator means may be by way of alarm signals transmitted
to the indicator means, for example, by radio. This would

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3) Alarme anhand von Stromleitungswerten.

enable a security guard at a main desk in a building, for example, to monitor equipment throughout the building.

5 The invention also extends to monitoring apparatus for
securing mains powered electrical equipment, said
monitoring apparatus comprising means for connection to a
mains supply, means for connection to equipment to be
secured, and a monitoring circuit for applying electrical
signals to said equipment connection means and signalling
10 an alarm if the application of electrical signals to
equipment by way of said equipment connection means is
disrupted.

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15 Preferably, said electrical signals are disrupted if
said equipment is powered-up for operation. Also, said
electrical signals may also be disrupted if said apparatus
is disconnected from its mains supply.

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20 Further, said monitoring apparatus may advantageously
comprise means for maintaining the power switch of
equipment to be secured permanently in its on position.
For example, said maintaining means may comprise one or
more tamper proof labels for application to equipment power
switches.

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25 Preferably, said monitoring circuit is arranged to
selectively apply to said equipment connection means a
monitoring signal for application to the equipment when not
in use, and an electrical power supply for powering the
30 equipment in use.

35 The monitoring signal may be a DC signal, for example,
a series of low voltage pulses, arranged to be applied to
the equipment when it is not in use by way of its normal
power supply lead.

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In a preferred embodiment, said monitoring circuit comprises first detector means arranged to detect said monitoring signal and to signal an alarm if the monitoring signal is disrupted.

5

Further, said monitoring circuit comprises control means for ceasing the application of said monitoring signal and supplying mains power to said equipment connection means. The monitoring circuit may be controlled, for
10 example, by a key and/or by coded input means.

Preferably, said monitoring circuit further comprises mains supply detector means arranged to monitor the supply of mains power supply to said mains supply connection means
15 and to signal an alarm if said mains power supply is disrupted.

The monitoring circuit also preferably comprises second detector means for monitoring the electrical power
20 supplied to the equipment connection means and to signal an alarm if said power supply is disrupted. In a modified embodiment, said second detector means is also arranged to signal an alarm if overload power is applied to said equipment connection means.

25

Preferably, said monitoring apparatus is provided with indicator means arranged to indicate that an alarm has been signalled by the monitoring circuit. Said indicator means may comprise, for example, visual display and/or audible
30 alarms. The indicator means may be remote from the monitoring circuit, if required. In this case, the monitoring circuit comprises transmitting means for transmitting alarm signals to the indicator means.

35

The monitoring circuit preferably comprises a user input interface, which may be controlled by way of key

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operation and/or by a keyboard. Said interface enables an authorised user to change the electrical signals fed to the equipment connection means, for example, to apply electrical power thereto when use of the equipment is required. The interface may also enable overriding of the monitoring circuit when it is required to disconnect equipment therefrom.

By way of a further advantage, and particularly for safety reasons, the monitoring circuit may also serve to determine if an overload condition has arisen.

summary:
Further, the invention may be advantageously arranged for incorporation into a standard, or pre-existing, general security or burglary alarm system. As such, correct enabling or accessing of the alarm system likewise determines the correct enabling or accessing of the invention.

An embodiment of the present invention will hereinafter be described, with reference to the accompanying drawing, in which the single Figure shows schematically monitoring apparatus of the present invention and its connection to electrical equipment.

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The monitoring apparatus illustrated in the Figure comprises a module 1 which is connected, as indicated at 4, to a mains electrical supply. Within the module 1, the mains supply is distributed to four channel outputs 10 which each preferably comprise a substantially conventional electrical power socket. Physically, the monitoring module 1 may resemble a multi-socket extension power cable. Electrical equipment, generally indicated at 2, is connected in conventional manner to one of the channels 10 of the module 1 by way of its power cable 3 and its conventional plug 6. The on/off switch 5 of the equipment

2 is kept closed in its on position, and is preferably maintained in that condition, for example, by way of a tamper proof label (not shown).

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5 The module 1 comprises a central processor 12 which is responsive to a user interface 14 and controls the application of electrical signals to the respective channel output 10, which provides equipment connection means, and hence to the equipment 2. The processor 12 also controls
10 detection circuits 18. As indicated, power from the mains supply 4 is applied to a high voltage interface 16 of the module 1 and is used, when required to power the equipment
2. If it is not required to power the equipment 2, the central processor 12 causes a low voltage monitoring
15 signal, for example, a series of pulses, to be applied to the equipment 2 by way of its power line 3. In general, the monitoring signal is applied to the equipment 2 by way of the live wire of the line 3 and returned to the module 1 by way of the neutral wire. The low voltage signal is
20 chosen such that the equipment 2 is transparent thereto. An appropriate low voltage detector circuit is provided in detection circuits 18 to monitor the return of the monitoring signal. If, at any time, the monitoring signal is interrupted or distorted, this is detected by this first
25 detector and the central processor 12 is arranged to actuate alarm indicator means (not shown) by way of buffers 20.

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30 If it is subsequently required to power the equipment 2, this is done by way of the user interface 14. A key holder, for example, inserts a security key into the interface 14 of the module 1 and by way of appropriate push buttons, control knobs and the like (not shown), the user is then enabled to indicate that the equipment 2 is to be
35 powered. In response, the central processor 12 removes application of the monitoring signal from the particular

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channel output 10, and hence from equipment 2 and enables the application of the mains supply thereto by way of the high voltage interface 16. A high power detector of the detection circuit 18 is then controlled to monitor the supply of power to the equipment 2 by way of the output channel 10. The high power detector signals to the central processor 12 if any interruption or disruption in the power supply is detected. The module 1 may also be provided with overload protection circuitry, for example, comprising a further detector enabled to signal an alarm if the power supplied to the equipment 2 exceeds a predetermined level. The central processor 12 is arranged to actuate the alarm indicator means by way of the buffers 20 upon receipt of an alarm signal from the high power detector or the mains supply detector.

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It will be appreciated from the above that in use of the monitoring apparatus the equipment 2 is continually monitored whether or not it is being powered and the alarm system is actuated if the monitoring signal or the power supply is interrupted. This may signify, for example, that the equipment 2 has been disconnected from the module 1. The existence of an alarm condition is also signalled if the mains supply 4 is interrupted, either by disconnection of the module 1 from the mains supply 4 or by a power failure.

Furthermore, the module 1 is provided with a standby battery circuit, indicated at 22, arranged to maintain at least the monitoring signal to the equipment 2 in the event of a power failure. The standby battery circuit 22 is continually supplied by power from the mains supply 4, when mains power is available, so that the battery thereof is always fully charged. A power supply circuit 24 within the module 1 receives the mains power and provides regulated low voltage power for the central processor 12 and the

circuits it controls.

As has been made clear above, control of the module 1 will be by way of an authorised person who may be a key holder, or have knowledge of appropriate input codes. The authorised user can enable the equipment 2 to be powered when required, switched off when not required, and disconnected from the module 1 when it is required to resite the equipment. The authorised user can also enable the module 1 to be disconnected from the mains supply without an alarm being given, for example, for resiting equipment as required.

The alarm indicator means may comprise visual displays, audible sounders or any other means. The indicator means may be provided on or near the module 1 or may be located remotely thereof. Where remote indicator means are provided, the module 1 may incorporate radio or other transmitter means for transmitting alarm signals to the remote indicator means.

It will be appreciated that the module 1 may be provided with appropriate control buttons, key locks and the like to enable the authorised user to interface with the input interface 14. Furthermore, appropriate displays, lights and the like may be provided to inform the authorised user of the state of the module 1 and of the appropriate channel outputs 10. In this respect, each of the channel outputs 10 is arranged to be monitored individually and to have a respective individual item of equipment connected thereto. Each individual item of equipment connected to a particular module 1 can be powered as required quite independently of the state of the other channels and of the equipment connected to those other channels.

It will be appreciated that in the case of computer equipment, for example, the module 1 can monitor not only attempted physical removal of the equipment 2 but also unauthorised use thereof. Thus, if an attempt is made to
5 power the equipment 2 without the proper intervention of an authorised user, an appropriate alarm indication will be given.

The module 1 comprises, as described above, a central
10 processor 12 which controls the operation thereof, the application of power to the items of equipment 2, and the provision of appropriate alarm indications. In this respect, the processor 12 will be controlled by appropriate software routines. Details of the software routines which
15 are necessary are not described herein as these will be readily within the competence of any one skilled in the art.

It has been explained above that the normal power
20 switch 5 of each item of equipment 2 is kept in the on position. Its movement, deliberately or inadvertently to an off position is preferably prevented by the application of a tamper proof security label. In addition, warning labels are preferably attached to the secured equipment 2,
25 for example, to show that the equipment is being monitored for security purposes.

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It will be appreciated that modifications to and variations in the specific embodiment described above and
30 illustrated may be made within the scope of this application.

CLAIMS

1. A method of securing mains powered electrical equipment using the mains power lead thereof as the, or a
5 part of a, monitoring circuit for the equipment.
2. A method of securing mains powered electrical equipment, said method comprising the steps of coupling a
10 mains electrical supply to equipment to be secured by way of a monitoring circuit, the monitoring circuit being arranged to apply electrical signals to said equipment, monitoring the application of the electrical signals to the equipment, and signalling an alarm if the application of electrical signals to the equipment is disrupted.
- 15 3. A method as claimed in claim 1 or 2, comprising the further step of monitoring said equipment to determine if operating power has been supplied to said equipment.
- 20 4. A method as claimed in claim 3, comprising the further step of monitoring said equipment to determine if the supply of operating power to said equipment has been disrupted.
- 25 5. A method as claimed in claim 2, wherein said electrical signals are disrupted if said equipment is powered-up for operation. *in te B.B*
- 30 6. A method as claimed in claim 5, wherein said electrical signals are disrupted if said equipment is disconnected from its mains supply.
- 35 7. A method as claimed in claim 2, 5 or 6, wherein the electrical signals applied to the equipment by the monitoring circuit comprise selectively a monitoring signal for application to the equipment when not in use, and an

electrical power supply for powering the equipment in use.

5 8. A method as claimed in claim 7, wherein the monitoring signal is a DC signal, for example, a series of low voltage pulses, which is applied to the equipment when it is not in use by way of its normal power supply lead, and wherein said monitoring circuit is arranged to signal an alarm if the monitoring signal is disrupted.

10 9. A method as claimed in claim 7, wherein the monitoring signal is a synthesized low voltage 50Hz AC signal.

15 10. A method as claimed in claim 7, 8 or 9, further comprising the step of removing the application of the monitoring signal and applying the mains power supply thereto to power the equipment to enable normal use of the equipment, selection of the mains power supply being enabled only in authorised circumstances.

20 11. A method as claimed in claim 10, wherein when the mains power supply is applied to the equipment, the monitoring circuit monitors the electrical power supplied and signals an alarm in the event of any disruption to the power supply.

25 12. A method as claimed in any one of claims 2 or 5 to 11, wherein the alarm by the monitoring circuit is signalled by visual displays, and/or sounders, and/or other indicator means.

30 13. A method as claimed in any one of the preceding claims, comprising the further step of keeping the power switch of the equipment to be secured in its ON position.

35 14. A method as claimed in any one of the preceding claims, wherein only the live and neutral wires of the

power lead are employed for monitoring said equipment.

15. A method as claimed in any one of the preceding claims, wherein said monitoring circuit is arranged to
5 determine if an overload condition arises.

16. Monitoring apparatus for securing mains powered electrical equipment, said monitoring apparatus comprising means for connection to a mains supply, means for
10 connection to equipment to be secured, and a monitoring circuit for applying electrical signals to said equipment connection means and signalling an alarm if the application of electrical signals to equipment by way of said equipment connection means is disrupted.

15

17. Monitoring apparatus as claimed in claim 16, wherein said electrical signals are disrupted if said equipment is powered-up for operation.

20 18. Monitoring apparatus as claimed in claim 17, wherein said electrical signals are disrupted if said equipment is disconnected from its mains supply.

19. Monitoring apparatus as claimed in any one of claims
25 16, 17 or 18, wherein said monitoring circuit comprises first detector means arranged to detect said monitoring signal and to signal an alarm if the monitoring signal is disrupted.

30 20. Monitoring apparatus as claimed in claim 19, wherein said monitoring circuit further comprises control means for ceasing the application of said monitoring signal and supplying mains power to said equipment connection means.

35 21. Monitoring apparatus as claimed in claim 20, wherein said monitoring circuit further comprises mains supply

detector means arranged to monitor the supply of mains power to said mains supply connection means and to signal an alarm if said mains power supply is disrupted.

- 5 22. Monitoring apparatus as claimed in claim 21, wherein the monitoring circuit also preferably comprises second detector means for monitoring the electrical power supplied to the equipment connection means and to signal an alarm if said power supply is disrupted.

10

23. Monitoring apparatus as claimed in any one of claims 16 to 22, wherein said monitoring circuit comprises a user input interface, which may be controlled by way of key operation and/or by a keyboard.

15

24. Monitoring apparatus as claimed in any one of claims 16 to 23, wherein only the live and neutral wires of the mains-supply connection means comprise part of said monitoring circuit.

20

25. Monitoring apparatus as claimed in claims 16 to 24, further comprising means for maintaining the power switch of equipment to be secured permanently in its ON position.

25

26. A method of securing mains powered electrical equipment substantially as hereinbefore described with reference to the accompanying drawing.

30

27. Monitoring apparatus for securing mains powered electrical equipment substantially as hereinbefore described with reference to the accompanying drawing.

*Erfindung ist ausgestellt in der BB und Anstellungen
sicherungen mit der neuen Operation*

Patents Act 1977
Examiner's report to the Comptroller under Section 17
(The Search report)

Application number
GB 9401087.3

Relevant Technical Fields

- (i) UK Cl (Ed.M) G4N (NCSE)
(ii) Int Cl (Ed.5) G08B 13/14

Search Examiner
D L SUMMERHAYES

Date of completion of Search
15 MARCH 1994

Databases (see below)

(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

Documents considered relevant following a search in respect of Claims :-
1-27

(ii)

Categories of documents

- | | |
|--|---|
| <p>X: Document indicating lack of novelty or of inventive step.</p> <p>Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.</p> <p>A: Document indicating technological background and/or state of the art.</p> | <p>P: Document published on or after the declared priority date but before the filing date of the present application.</p> <p>E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.</p> <p>&: Member of the same patent family; corresponding document.</p> |
|--|---|

Category	Identity of document and relevant passages		Relevant to claim(s)
X	GB 2215106 A	(DYNAMIC PROTECTION)	1, 2, 12, 14, 16, 19, 24
X,P	US 5243328	(LEE)	1, 2, 4, 6, 12, 14, 16, 18, 19, 24
X	US 4736195	(McMURTRY)	1, 2, 4, 6, 7, 12, 14, 16, 17, 18, 19, 20, 23, 24
X	US 3633199	(CURRY)	1, 2, 4, 12, 14, 16, 19, 24

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